

Charge Injection in Organics

George Malliaras, Cornell University, DMR-0094047

Tunability of electronic properties via chemical synthesis, ease of processing, and efficient emission make organics attractive for applications in flat panel displays and lighting. Metal electrodes inject electrons and holes into an organic semiconductor layer, leading to the formation of excited molecules, which emit light corresponding to the molecular energy gap. These organic light emitting diodes (OLEDs) require a low work function cathode for efficient electron injection. Unfortunately, such metals (e.g. Ca) oxidize easily and cause device degradation. We have found that the presence of mobile ions in particular organometallic molecules enhances electron injection: Ions pile up near the electrode and assist charge injection. As a result, efficient OLEDs can now be made utilizing air-stable electrodes (such as Au), as shown in the figure. Temporal response and color tuning are current research issues.

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Education and Outreach

Contributors to this work:

Graduate Students: Yulong Shen¹⁾, Jason Slinker, Dan Bernards.

Undergraduate Students: Alon Gorodetsky²⁾, Sara Parker³⁾

REU Students: Mike Campolongo (Rowan), Audrey Bowen (Simmons).

Postdoc: Ahmad Hosseini.

Collaborators: Profs. Héctor Abruña, Paul Houston (Cornell), Stefan Bernhard (Princeton).

¹⁾ Received Ph.D. August '03. Now at Dupont Displays, Wilmington, DE.

²⁾ Now at Graduate School at Caltech.

³⁾ Awards: Goldwater Fellowship, In.tel UG Research Award, GE Faculty for the Future Fellowship.

Dissemination of results:

- Two review papers (Chem. Comm., and Chem. Phys. Chem.).
- Presentation “Materials for the 21st Century” to visiting high school students and parents.
- Industrial Course “Organic semiconductors and devices” given to UCB Chemicals.